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National Eutrophication Survey, Corvallis, Oreg

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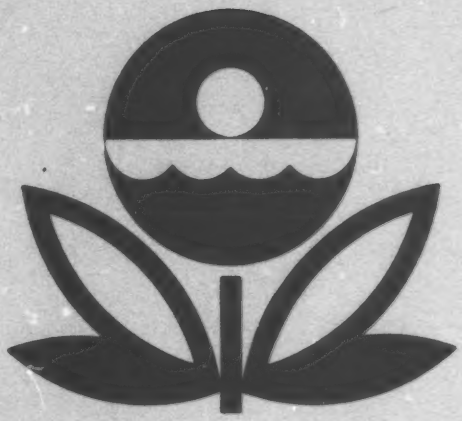

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
BIG SANDY RESERVOIR
SUBLETTE AND SWEETWATER COUNTIES
WYOMING
EPA REGION VIII
WORKING PAPER No. 881

WITH THE COOPERATION OF THE
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
AND THE
WYOMING NATIONAL GUARD
JULY, 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wyoming Department of Environmental Quality for professional involvement, to the Wyoming National Guard for conducting the tributary sampling phase of the Survey, and to those Wyoming wastewater treatment plant operators who voluntarily provided effluent samples.

The staff of the Water Quality Division provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

Brigadier General James L. Spence, The Adjutant General of Wyoming, and Project Officer Colonel Donald L. Boyer, who directed the volunteer efforts of the Wyoming National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of Wyoming

NAME	COUNTY
Big Sandy	Sublette, Sweetwater
Boulder	Sublette
Boysen	Fremont
De Smet	Johnson
Flaming Gorge	Sweetwater, WY; Daggett, UT
Fremont	Sublette
Glendo	Converse, Platte
Keyhole	Crook
Ocean	Fremont
Seminoe	Carbon
Soda	Sublette
Viva Naughton	Lincoln
Woodruff Narrows	Uinta
Yellowtail	Bighorn, WY; Bighorn, Carbon, MT

BIG SANDY RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0 5 10 15 20 Km.
0 5 10 Mi.
Scale
Creek
Dutch Joe
River
Sandy
Big
Wyom.
Map Location
A2
Canal
BIG SANDY RESERVOIR
D2
dam
B1
outlet
A1
Eden Valley Reservoir
Big Sandy Pipe
Canal
42°48'
42°30'
42°15'
109°30'
109°15'

BIG SANDY RESERVOIR

STORET NO. 5601

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Big Sandy Reservoir is eutrophic. It ranked tenth in overall trophic condition when the 14 Wyoming lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. All of the other water bodies had less median total phosphorus, 12 had less median dissolved orthophosphorus, six had less median inorganic nitrogen, three had less mean chlorophyll a, and all of the others had greater mean Secchi disc transparency. No significant depression of dissolved oxygen with depth occurred at any of the sampling times.

Survey limnologists observed heavy turbidity on each sampling occasion. The Wyoming Game and Fish Commission reports that the turbidity is due to finely divided, almost colloidal silt and is serious enough to have depressed the brown trout population in the reservoir (Miller, 1973).

B. Rate-Limiting Nutrient:

Due to significant changes in the sample nutrient levels, the assay results are not considered representative of conditions in the reservoir at the times the samples were taken.

The reservoir data indicate nitrogen limitation at all sampling times; however because of turbidity, primary productivity probably is light-limited much of the time.

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* See Appendix A.

C. Nutrient Controllability:

1. Point sources--No known point sources impacted Big Sandy Reservoir during the sampling year.

2. Non-point sources--The Big Sandy River contributed 71.7% of the total phosphorus load to the reservoir, and the minor tributaries and immediate drainage contributed an estimated 26.8% of the load.

The reservoir received a total phosphorus loading over twice that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11). The apparent lack of nuisance plant growth in the lake probably is due to light limitation caused by turbidity.

II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 8.34 kilometers^2.
2. Mean depth: 5.8 meters.
3. Maximum depth: 25.9 meters.
4. Volume: 48.372 x 10^6 m^3.
5. Mean hydraulic retention time: 273 days (based on outflow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Big Sandy River	834.0	2.450
Minor tributaries & immediate drainage -	297.3	0.012
Totals	1,131.3	2.462

2. Outlets -

Means Canal	0.0	1.960
Big Sandy River	1,139.6	0.089
Totals	1,139.6**	2.049**

C. Precipitation***:

1. Year of sampling: 14.9 centimeters.
2. Mean annual: 20.0 centimeters.

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† Table of metric conversions--Appendix B.
†† Prior, 1974.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of reservoir; lesser outflow due to evaporation.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Big Sandy Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at two stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 13.4 meters at station 1 and 7.3 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR BIG SANDY RESERVOIR
STORET CODE 5601

PARAMETER	1ST SAMPLING (5/19/75) 2 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (9/ 2/75) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/16/75) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	5.3 - 6.5	6.2	6.4	15.2 - 16.4	15.7	15.6	8.0 - 8.9	8.5	8.6
DISS OXY (MG/L)	8.4 - 10.6	9.2	9.2	6.2 - 7.4	6.8	7.0	8.6 - 9.2	8.9	8.8
CNDCTVY (MCROMO)	119. - 127.	122.	121.	85. - 92.	89.	89.	97. - 99.	98.	98.
PH (STAND UNITS)	8.1 - 8.5	8.3	8.4	7.5 - 7.9	7.6	7.6	8.0 - 8.3	8.1	8.1
TOT ALK (MG/L)	60. - 66.	63.	62.	32. - 54.	37.	34.	39. - 46.	41.	41.
TOT P (MG/L)	0.077 - 0.111	0.092	0.083	0.080 - 0.111	0.093	0.092	0.080 - 0.089	0.085	0.084
ORTHO P (MG/L)	0.012 - 0.040	0.024	0.023	0.018 - 0.022	0.020	0.021	0.013 - 0.020	0.016	0.016
NO2+NO3 (MG/L)	0.020 - 0.050	0.024	0.020	0.020 - 0.020	0.020	0.020	0.030 - 0.030	0.030	0.030
AMMONIA (MG/L)	0.020 - 0.040	0.032	0.030	0.020 - 0.280	0.057	0.030	0.020 - 0.030	0.029	0.030
KJEL N (MG/L)	0.400 - 0.700	0.489	0.400	0.300 - 0.600	0.422	0.400	0.400 - 0.400	0.400	0.400
INORG N (MG/L)	0.040 - 0.090	0.057	0.050	0.040 - 0.300	0.077	0.050	0.050 - 0.060	0.059	0.060
TOTAL N (MG/L)	0.420 - 0.750	0.513	0.420	0.320 - 0.620	0.442	0.420	0.430 - 0.430	0.430	0.430
CHLRPYL A (UG/L)	5.2 - 5.5	5.3	5.3	2.9 - 4.4	3.6	3.6	4.0 - 4.3	4.1	4.1
SECCHI (METERS)	0.3 - 0.4	0.3	0.3	0.3 - 0.3	0.3	0.3	0.3 - 0.3	0.3	0.3

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/19/75	1. Centric diatoms	568
	2. Chroomonas (?) sp.	512
	3. Cryptomonas sp.	57
	4. Surirella sp.	28
	5. Nitzschia sp.	28
	Total	1,193
09/02/75	1. Aphanizomenon sp.	577
	2. Chroomonas (?) sp.	241
	3. Cryptomonas sp.	120
	4. Schroederia sp.	48
	Total	986
10/16/75	1. Chroomonas (?) sp.	1,050
	2. Cryptomonas sp.	131
	3. Schroederia sp.	98
	Total	1,279

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/19/75	1	5.2
	2	5.5
09/02/75	1	4.4
	2	2.9
10/16/75	1	4.0
	2	4.3

C. Limiting Nutrient Study:

Due to significant changes in nutrients in the samples during shipment from the field to the laboratory, the algal assay results

are not considered representative of conditions in the reservoir at the times the samples were collected (05/19/75 and 10/16/75).

The reservoir data indicate nitrogen limitation at all sampling times (the mean inorganic nitrogen/orthophosphorus ratios were 4/1 or less, and nitrogen limitation would be expected).

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Wyoming National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff month of May when two samples were collected. Sampling was begun in October, 1974, and was completed in July, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wyoming District Office of the U.S. Geological Survey for the tributary sites nearest the reservoir.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in $kg/km^2/year$, at station A-2 and multiplying by the ZZ area in km^2.

No known wastewater treatment plants impacted the reservoir during the sampling year.

* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Big Sandy River	7,160	71.7
b. Minor tributaries & immediate drainage (non-point load) -	2,675	26.8
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	?	?
e. Known industrial - None	-	-
f. Direct precipitation* -	145	1.5
Total	9,980	100.0

2. Outputs -

Reservoir outlets -

Means Canal	7,075
Big Sandy River	1,410
Total	8,485

3. Net annual P accumulation - 1,495 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Big Sandy River	92,145	68.8
b. Minor tributaries & immediate drainage (non-point load) -	32,705	24.5
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation* -	9,005	6.7
Total	133,855	100.0

2. Outputs -

Reservoir outlets -

Means Canal	67,520
Big Sandy River	31,985
Total	99,505

3. Net annual N accumulation - 34,350 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg $P/km^2/yr$	kg $N/km^2/yr$
Big Sandy River	9	110

* See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	1.20	0.18	16.0	4.1

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Big Sandy Reservoir:

"Dangerous" (eutrophic loading)	0.54
"Permissible" (oligotrophic loading)	0.27

V. LITERATURE REVIEWED

Miller, Don, 1973. Big Sandy Reservoir summation report. Project 0472-01-5502, WY Game & Fish Comm., Cheyenne.

Prior, Roy E., 1974. Personal communication (reservoir morphometry). WY Dept. of Env. Qual., Cheyenne.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
5601	BIG SANDY RESERVOIR	0.087	0.060	487.667	4.383	8.800	0.020
5602	BOULDER LAKE	0.008	0.040	361.800	2.483	8.400	0.002
5603	BOYSEN RESERVOIR	0.037	0.140	465.923	6.264	14.400	0.014
5604	LAKE DE SMET	0.033	0.040	409.000	11.167	9.400	0.006
5605	FLAMING GORGE RESERVOIR	0.014	0.605	366.461	5.611	12.200	0.003
5606	FREMONT LAKE	0.006	0.040	-22.000	3.783	7.400	0.002
5607	GLENDO RESERVOIR	0.045	0.315	459.182	8.473	12.600	0.014
5608	KEY HOLE RESERVOIR	0.028	0.050	454.583	7.792	14.000	0.004
5609	OCEAN LAKE	0.043	0.040	478.333	7.500	8.600	0.004
5610	SEMINOLE RESERVOIR	0.030	0.130	447.000	2.536	11.000	0.007
5611	SODA LAKE	0.063	0.040	387.500	5.575	15.000	0.014
5612	VIVA NAUGHTON RESERVOIR	0.065	0.120	430.000	25.067	13.200	0.024
5613	WOODRUFF NARROWS RESERVO	0.069	0.105	470.000	12.950	13.200	0.019
5614	YELLOWTAIL RESERVOIR	0.026	0.310	364.500	5.410	10.000	0.017

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
5601	BIG SANDY RESERVOIR	0 (0)	54 (7)	0 (0)	77 (10)	77 (10)	8 (1)	216
5602	BOULDER LAKE	92 (12)	92 (11)	92 (12)	100 (13)	92 (12)	92 (12)	560
5603	BOYSEN RESERVOIR	46 (6)	23 (3)	23 (3)	46 (6)	8 (1)	42 (5)	188
5604	LAKE DE SMET	54 (7)	73 (9)	62 (8)	15 (2)	69 (9)	62 (8)	335
5605	FLAMING GORGE RESERVOIR	85 (11)	0 (0)	77 (10)	54 (7)	46 (6)	85 (11)	347
5606	FREMONT LAKE	100 (13)	73 (9)	100 (13)	85 (11)	100 (13)	100 (13)	558
5607	GLENDO RESERVOIR	31 (4)	8 (1)	31 (4)	23 (3)	38 (5)	42 (5)	173
5608	KEY HOLE RESERVOIR	69 (9)	62 (8)	38 (5)	31 (4)	15 (2)	69 (9)	284
5609	OCEAN LAKE	38 (5)	92 (11)	8 (1)	38 (5)	85 (11)	77 (10)	338
5610	SEMINOLE RESERVOIR	62 (8)	31 (4)	46 (6)	92 (12)	54 (7)	54 (7)	339
5611	SODA LAKE	23 (3)	92 (11)	69 (9)	62 (8)	0 (0)	31 (4)	277
5612	VIVA NAUGHTON RESERVOIR	15 (2)	38 (5)	54 (7)	0 (0)	27 (3)	0 (0)	134
5613	WOODRUFF NARROWS RESERVO	8 (1)	46 (6)	15 (2)	8 (1)	27 (3)	15 (2)	119
5614	YELLOWTAIL RESERVOIR	77 (10)	15 (2)	85 (11)	69 (9)	62 (8)	23 (3)	331

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	5602	BOULDER LAKE	560
2	5606	FREMONT LAKE	558
3	5605	FLAMING GORGE RESERVOIR	347
4	5610	SEMINOLE RESERVOIR	339
5	5609	OCEAN LAKE	338
6	5604	LAKE DE SMET	335
7	5614	YELLOWTAIL RESERVOIR	331
8	5608	KEY HOLE RESERVOIR	284
9	5611	SODA LAKE	277
10	5601	BIG SANDY RESERVOIR	216
11	5603	BOYSEN RESERVOIR	188
12	5607	GLENDO RESERVOIR	173
13	5612	VIVA NAUGHTON RESERVOIR	134
14	5613	WOODRUFF NARROWS RESERVO	119

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WYOMING 08/05/76

LAKE CODE 5601 BIG SANDY RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1139.6

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5601A1	1139.6	0.0	0.0	0.0	0.142	0.170	0.708	0.057	0.0	0.0	0.0	0.0	0.0	0.089
5601A2	834.0	0.31	0.34	0.62	1.44	6.68	11.41	4.67	1.27	0.79	0.85	0.59	0.37	2.45
5601B1	0.0	0.0	0.0	0.0	0.0	2.690	8.495	7.079	4.672	0.425	0.0	0.0	0.0	1.960
5601D1	46.6	0.0	0.0	0.0	0.0	0.028	0.028	0.0	0.0	0.0	0.0	0.0	0.0	0.005
5601ZZ	259.0	0.0	0.0	0.0	0.028	0.057	0.057	0.0	0.0	0.0	0.0	0.0	0.0	0.012

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1139.6
SUM OF SUB-DRAINAGE AREAS = 1139.6
TOTAL FLOW IN = 52.92
TOTAL FLOW OUT = 1.08

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5601A1	10	74	0.057	5	0.057				
	11	74	0.057	18	0.057				
	12	74	0.057	9	0.057				
	1	75	0.057						
	2	75	0.057						
	3	75	0.057	13	0.057				
	4	75	0.057	16	0.057				
	5	75	0.057	8	0.057	23	0.057		
	6	75	0.850	9	0.057				
	7	75	2.407	2	2.832	27	0.057		
	8	75	0.057						
	9	75	0.057						
5601A2	10	74	0.510	5	0.538				
	11	74	0.425	18	0.425				
	12	74	0.340	9	0.340				
	1	75	0.283						
	2	75	0.283						
	3	75	0.425	13	0.425				
	4	75	0.623	16	0.481				
	5	75	4.248	8	2.237	28	4.701		
	6	75	15.376	9	23.956				
	7	75	13.167	2	20.247	23	6.598		
	8	75	1.812						
	9	75	0.510						

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TRIBUTARY FLOW INFORMATION FOR WYOMING 08/05/76

LAKE CODE 5601 BIG SANDY RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
560181	10	74	0.003	5	0.003				
	11	74	0.003	18	0.003				
	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.0						
	4	75	0.006	16	0.003				
	5	75	0.708	8	0.006	28	2.549		
	6	75	8.637	9	11.610				
	7	75	7.929	2	11.610				
	8	75	7.079						
	9	75	2.124						
5601D1	10	74	0.0						
	11	74	0.0						
	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.0						
	4	75	0.0						
	5	75	0.028						
	6	75	0.028						
	7	75	0.0						
	8	75	0.0						
	9	75	0.0						
5601ZZ	10	74	0.0						
	11	74	0.0						
	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.0						
	4	75	0.028						
	5	75	0.057						
	6	75	0.057						
	7	75	0.0						
	8	75	0.0						
	9	75	0.0						

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APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/05

560101
42 14 53.0 109 25 53.0 3
BIG SANDY RESERVOIR
56037 WYOMING
110691

11EPALES 2111202
0048 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/19	09 45	0000	6.3	8.4	14	120	8.40	62	0.040	0.700	0.050	0.024
	09 45	0005	6.5	9.0		120	8.50	61	0.030	0.400	0.020	0.020
	09 45	0015	6.5	9.4		121	8.20	60	0.020	0.400	0.020K	0.012
	09 45	0030	6.1	9.2		119	8.50	61	0.030	0.400	0.020	0.013
	09 45	0044	5.3	9.2		120	8.40	61	0.030	0.400	0.020	0.014
75/09/02	14 55	0000	16.4	7.4	12	85	7.60	33	0.020	0.600	0.020	0.018
	14 55	0005	16.4	6.4		88	7.60	32	0.030	0.600	0.020	0.021
	14 55	0015	15.2	7.0		87	7.55	34	0.040	0.400	0.020	0.019
	14 55	0030	15.6	6.2		88	7.50	33	0.040	0.400	0.020	0.020
	14 55	0044	15.5	6.8		90	7.50	34	0.280	0.400	0.020	0.018
75/10/16	14 45	0000	8.9	8.6	12	98	8.30	46	0.030	0.400	0.030	0.013
	14 45	0005	8.9	8.8		99	8.20	43	0.030	0.400	0.030	0.020
	14 45	0015	8.7	9.0		98	8.10	41	0.030	0.400	0.030	0.017
	14 45	0035	8.6	8.8		98	8.10	39	0.030	0.400	0.030	0.015

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/19	09 45	0000	0.083	5.2	
	09 45	0005	0.077		
	09 45	0015	0.079		
	09 45	0030	0.077		
	09 45	0044	0.081		
75/09/02	14 55	0000	0.101	4.4	
	14 55	0005	C.093		
	14 55	0015	0.091		
	14 55	0030	0.086		
	14 55	0044	0.111		
75/10/16	14 45	0000	0.083	4.0	
	14 45	0005	0.089		
	14 45	0015	0.080		
	14 45	0035	0.083		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

560102
42 16 28.0 109 26 52.0 3
BIG SANDY RESERVOIR
56035 WYOMING

110691

11EPALES 2111202
0027 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/19	10 15	0000	6.3	10.6	13	124	8.50	64	0.030	0.600	0.020	0.023
	10 15	0005	6.4	8.8		126	8.30	64	0.040	0.600	0.030	0.040
	10 15	0015	6.4	9.0		123	8.20	66	0.040	0.500	0.020	0.035
	10 15	0023	6.4	9.2		127	8.10	66	0.030	0.400	0.020	0.033
75/09/02	15 20	0000	16.1	7.0	11	91	7.80	35	0.020	0.500	0.020K	0.022
	15 20	0005	15.6	6.4		92	7.90	54	0.040	0.300	0.020K	0.021
	15 20	0015	15.3	7.4		89	7.70	37	0.020K	0.300	0.020K	0.021
	15 20	0024	15.2	7.0		89	7.60	37	0.020K	0.300	0.020	0.022
75/10/16	13 10	0000	8.1	8.8	12	97	8.00	39	0.030	0.400	0.030	0.013
	13 10	0005	8.0	9.2		99	8.00	40	0.030	0.400	0.030	0.020
	13 10	0015	8.0	9.2		98	8.00	41	0.020	0.400	0.030	0.016

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/19	10 15	0000	0.109	5.5	
	10 15	0005	0.111		
	10 15	0015	0.108		
	10 15	0023	0.105		
75/09/02	15 20	0000	0.090	2.9	
	15 20	0005	0.092		
	15 20	0015	0.080		
	15 20	0024	0.093		
75/10/16	13 10	0000	0.084	4.3	
	13 10	0005	0.087		
	13 10	0015	0.086		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/08/05

5601A1
42 14 32.0 109 24 45.0 4
BIG SANDY RIVER
56 7.5 W EDEN RES
O/BIG SANDY RESERVOIR 110691
BNK 100 FT W OF RD 1.1 MI SE OF DAM
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/05	12	10	0.016	1.700	0.030	0.005K	0.010
74/11/18	13	50	0.008	0.600	0.015	0.010	0.010
74/12/09	14	30	0.032	1.000	0.020	0.005	0.010K
75/03/13	14	15	0.035	0.250	0.015	0.010	0.030
75/04/16	17	30	0.020	1.200	0.035	0.015	0.030
75/05/08	12	43	0.020	0.800	0.025	0.010	0.020
75/05/23	16	02	0.040	2.650	0.050	0.040	
75/06/09	12	00	0.010	0.700	0.025	0.010	0.020
75/07/02	14	25	0.015	1.600	0.045	0.030	0.090

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

5601A2
42 19 05.0 109 29 05.0 4
BIG SANDY RIVER
56 7.5 BIG SNDY RES
T/BIG SANDY RESERVOIR 110691
OLD EDEN CANAL DIVERSION DAM
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/05	12 40		0.016	1.200	0.035	0.005	0.030
74/11/18	14 05		0.024	1.000	0.025	0.005	0.010
74/12/09	15 00		0.016	1.200	0.025	0.005K	0.010K
75/03/13	16 00		0.010	1.900	0.040	0.015	0.120
75/04/16	18 15		0.015	0.500	0.120	0.065	0.190
75/05/08	13 48		0.075	0.825	0.045	0.170	0.450
75/05/28	14 41		0.005	0.800	0.020	0.010	0.020
75/06/09	11 30		0.040	1.800	0.030	0.035	
75/07/02	14 45		0.010	1.350	0.040	0.020	0.120
75/07/23	18 45		0.025	0.500	0.015	0.015	0.080

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

560181
42 14 35.0 109 24 30.0 4
MEANS CANAL
56 7.5 W EDEN RES
T/BIG SANDY RESERVOIR 110691
SEC RD BRDG 1.2 MI E OF BIG SANDY DAM
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/05	11 50		0.016	1.400	0.020	0.005	0.015
74/11/18	13 35		0.008	1.100	0.030	0.005K	0.010K
75/01/14	13 30		0.080	2.000	0.044	0.010	0.025
75/04/16	17 00		0.105	0.550	0.170	0.040	0.050
75/05/08	12 47		0.020	0.100	0.020	0.010	0.010
75/05/28	14 31		0.025	0.650	0.040	0.030	0.100
75/06/09	11 50		0.010	0.350	0.020	0.025	0.080
75/07/02	14 20		0.020	0.450	0.035	0.040	0.090

K VALUE KNOWN TO BE
LESS THAN INDICATED